COMPLETE LISTING OF CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-38 (canceled)

39. (currently amended) An electronic cooling device for cooling a heat source, comprising:

a cathode comprising at least one microtip emitter structure on a base electrode, the microtip emitter structure comprising polycrystalline diamond, the emitter structure being characterized by having a semiconductor conduction band; ~~and~~

an anode positioned over and spaced apart from the cathode by a vacuum space,

the microtip emitter structure further comprising enhancement means for causing bending of the conduction band;

a power~~biasing energy~~ supply electrically connected to the cathode and anode, ~~adapted to bias the cathode to anode separation,~~ the power supply applying an electrical bias of sufficient potential to cause, in cooperation with the enhancement means, preferential emission of higher energy electrons from ~~the base electrode through~~ the cathode ~~into the conduction band, then~~ through the vacuum and deposition in the anode; and

the cathode is thermally connected to the heat source so that the preferential emission of high energy electrons from the cathode causes a corresponding transfer of thermal energy from the heat source to the anode.

~~the emitter structure including a diamond microtip emitting portion.~~

40. (currently amended) The electronic cooling device of claim 3~~6~~9, wherein the enhancement means comprises a ~~the diamond microtip emitting portion including a~~ geometric tip enhancement ~~for enhancing band bending~~.

41. (currently amended) An electronic cooling device, comprising:

a cathode comprising at least one emitter structure on a base electrode, the emitter structure including a diamond microtip ~~emitter~~ extending upwardly from and formed integral to a diamond substrate having a top surface;

an anode layer spaced apart from the emitter and suspended above the diamond substrate by a first insulating layer extending upwardly from the top surface of the diamond substrate;

a porous gate positioned above and spaced apart from the diamond microtip, supported by a second insulating layer extending upwardly from a top surface of the anode layer; ~~and~~

a biasing energy supply adapted to bias the anode and the gate ~~separation~~, the bias of sufficient potential to cause electron emission from the base electrode through the cathode into the conduction band, then through the vacuum and deposition in the anode; and

the cathode further comprising means to enhance preferential emission of higher energy electrons thereby to enhance transfer of thermal energy from the cathode to the anode.

42. (currently amended) The device of claim ~~38~~41, wherein the porous gate is constructed in a grid arrangement.

43. (currently amended) The device of claim ~~38~~41 wherein the porous gate ~~is constructed~~ comprises ~~is constructed in~~ an annular gate structure ~~adapted to provide appropriate electrical conditions for cathode emission, while also providing a path to the anode~~.

44 (canceled)

45. (currently amended) A method for energy conversion using an electronic device having a diamond microtip cathode separated from an anode by a vacuum space, the cathode being characterized by having a conduction band, the method comprising:

bending ~~shifting~~ the conduction ~~field emission~~ band to ~~with a positive voltage bias on the anode to narrow the potential barrier width to increase the probability of quantum tunneling to~~ increase preferential field emission of higher energy electrons and cause a corresponding enhanced ~~and produce a~~ transfer of thermal energy from the cathode to the anode.

46. (currently amended) The method for energy conversion of claim ~~42~~5, wherein the bending of ~~shifting~~ the conduction ~~field emission~~ band occurs in the cathode.

47. (currently amended) The method for energy conversion of claim ~~42~~5 wherein the electronic device includes a base electrode connected to the cathode at an interface and wherein the band bending occurs ~~the shifting occurring~~ near the base-electrode/cathode interface

48. (canceled)

49. (currently amended) The method for energy conversion of claim ~~42~~5 wherein the step of bending the conduction band to cause preferential transfer of high energy electrons comprises adding ~~occurring near~~ sp2-bonded molecular structures within the diamond structure ~~the shifting occurring near sp2-bonded elements of the polycrystalline structure~~.

50. (canceled)

51. (currently amended) The method for energy conversion of claim 4~~2~~5, further comprising:

decreasing the resistance to electron flow between the cathode and anode through the use of a gate electrode that is electrically biased ~~designed~~ to extract electrons from the cathode while allowing emitted electrons to bypass the gate.

Claims 52-55 (canceled)

56. A thermal to electrical ~~diamond emitter~~ energy conversion device ~~adapted to provide power to an external circuit,~~ comprising:

a thermal energy source;

a cathode comprising a diamond ~~with a~~ microtip emitter mounted on a base electrode~~structure~~, the cathode thermally connected to the thermal energy source;~~adapted to support a high density of energetic electrons and further adapted to be electrically connected to the external circuit~~;

an anode spaced from the cathode ~~and adapted to be electrically connected to the external circuit~~;

~~an annular gate electrode adapted to provide a low potential field sufficient for emission of electrons from the cathode tip to the anode by bypassing the annular gate; and~~

~~a biasing energy supply adapted to bias the anode and the gate separation, the bias of sufficient potential to cause electron emission from the base electrode through the cathode into the conduction band, then through the vacuum and deposition in the anode~~

an electrical load electrically connected to the anode and cathode; and

the cathode further comprising emission enhancement means to cause preferential emission of higher energy electrons from the cathode in response to transfer of thermal energy from the thermal energy source to the cathode, thereby to cause the anode and cathode to transfer electrical energy to the load.

57. (canceled)

58. (canceled)

59. (new) The device of Claim 56 wherein the emission enhancement means comprises a geometric of the diamond microtip emitter.

60. (new) The device of Claim 56 wherein the emission enhancement means comprises sp2-bonded molecular structures within the diamond microtip.

61. (new) The device of Claim 56 wherein the emission enhancement means comprises dopants within the cathode, the dopants producing bending of a conduction band associated with the cathode by space charge accumulation.